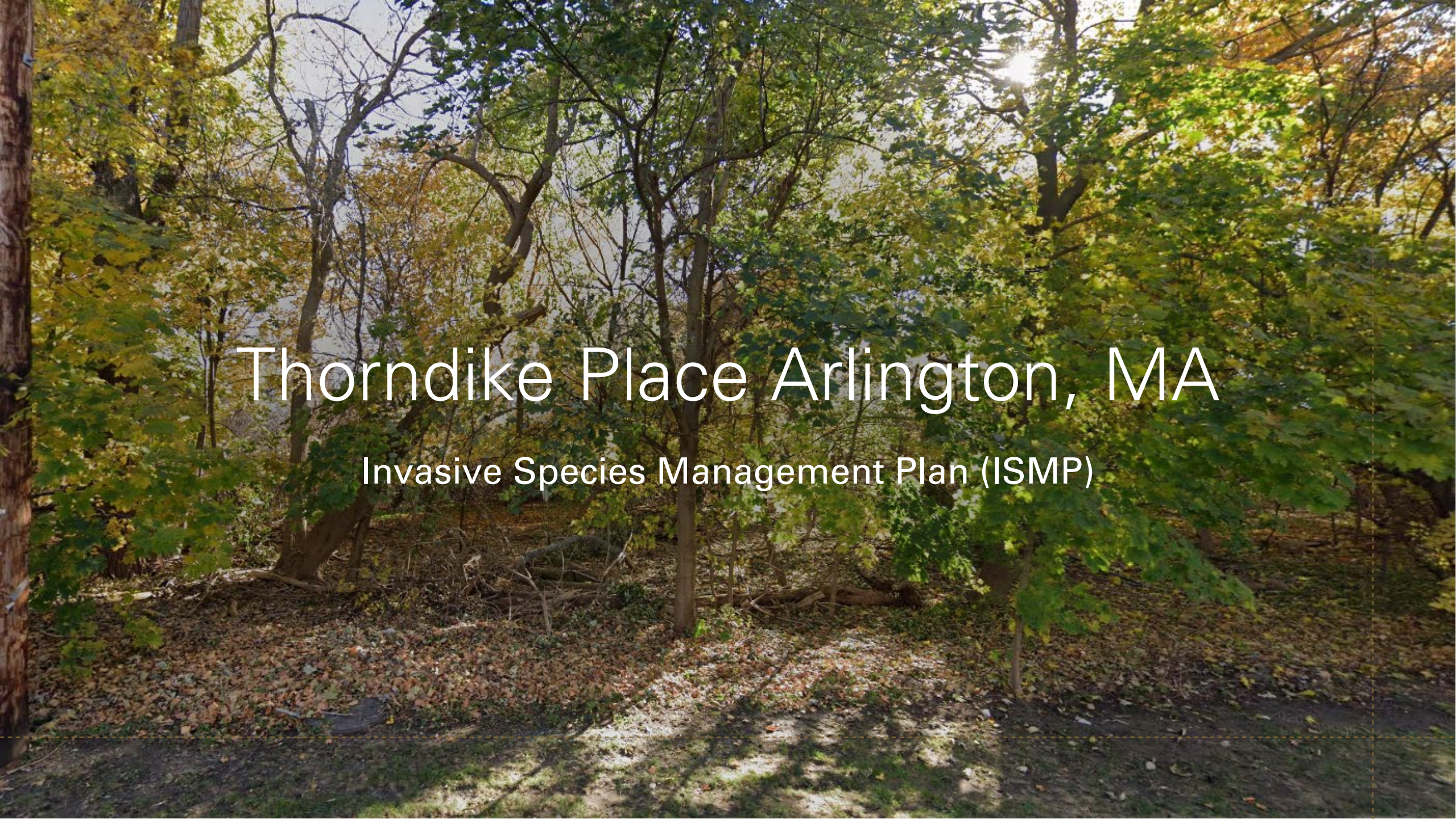


Thorndike Place Arlington, MA

Invasive Species Management Plan (ISMP)

Integrated Pest Management

- Types of Control Options
  - Cultural
  - Biological
  - Mechanical
  - Chemical

Mechanical Control

- Mulching
- Brushsaw
- Chainsaw
- Hand-pulling
- Site Specific
- Hybrid Approach

Pros:
- Improved access for future control efforts
- No Herbicides

Cons:
- Increased Disturbance
- Access Dependent
- Repeated Visits Necessary
- Not a long-term treatment on its own
- Expensive
- Non-discriminate

Herbicides

- Upland vs Wetland Formulations
  - Surfactants
- Glyphosate (Wetland Approved)
  - Non-ionic Surfactant
  - Application Method
  - LD50
  - ~40-day half-life
  - Quickly Binds/No Percolation
  - Sunlight/Bacteria/Fungi
  - Shikimate Pathway

Lethal dose comparison

Substance	LD50 (mg/kg of body weight)
glyphosate	4,900
table salt	3,000
acetaminophen	338
paraquat	100
nicotine	9

Herbicide Usage Other Industries

Forestry

- 2,4-D
- Citric Acid
- Clove oil
- Diquat
- Glyphosate
- Imazapyr
- Triclopyr

Golf Courses

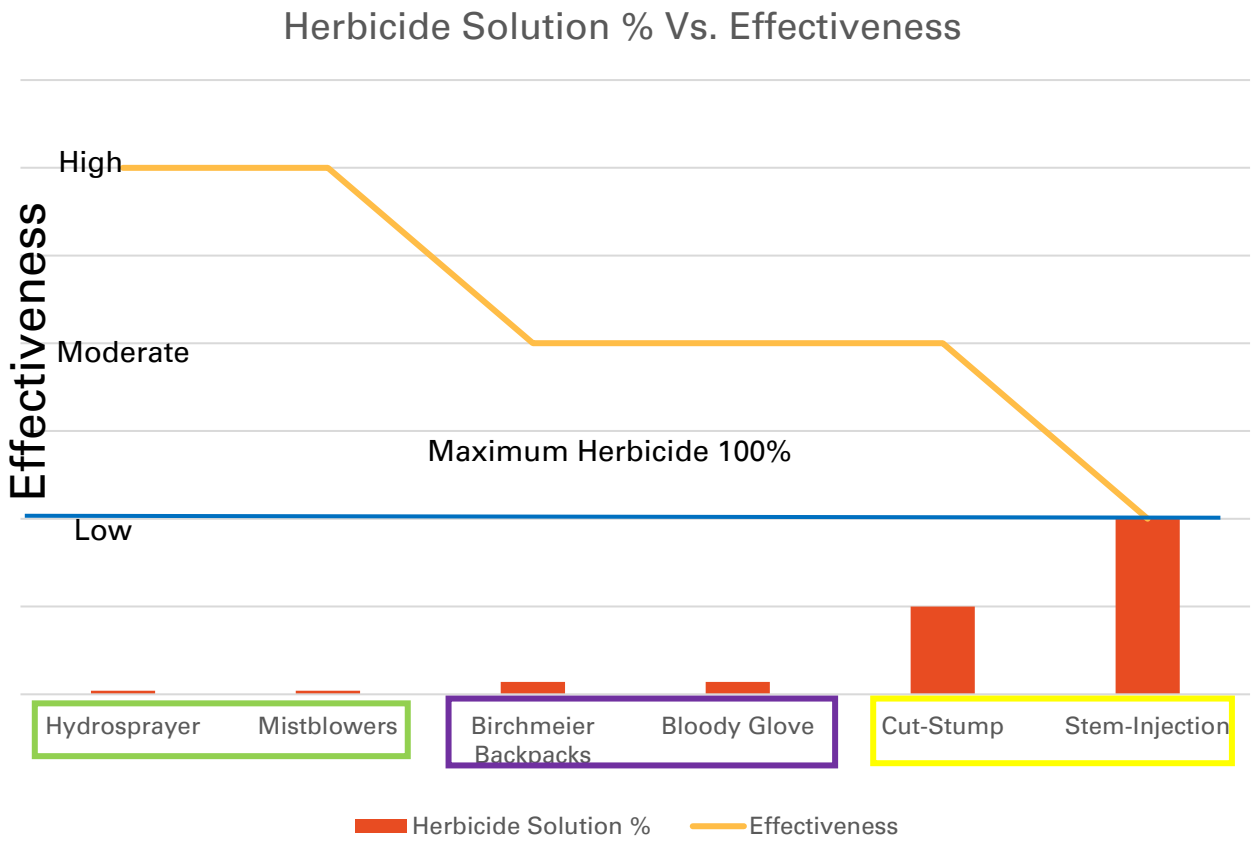
- 2,4-D
- Acibenzolar-S-methyl
- Aluminum tris
- Azoxystrobin
- Bensulide
- Bifenthrin
- Boscalid
- Carbaryl
- Carfentrazone
- Chlorantraniliprole
- Chloroneb
- Chlorothalonil
- Chlorpyrifos
- Clopyralid
- Clothianidin
- Cyfluthrin
- Dicamba
- Diquat
- Dithiopyr
- Ethephon
- Ethylenebisdithiocarbamate ic
- Fenoxaprop-ethyl
- Fludioxonil
- Fluoxastrobin
- Fluroxypyr
- Flurprimidol
- Flutolanil
- Glufosinate-ammonium
- Glyphosate
- Halofenozide
- Hydrogen dioxide
- Imidacloprid
- Indoxacarb
- Iprodione
- Lambda-cyhalothrin
- Mancozeb
- Maneb
- Manganese
- Mecoprop
- Mefenoxam
- Mefluidide
- Mesotrione
- Metconazole
- Mineral oil
- Myclobutanil
- Oxadiazon
- Paclobutrazol
- Pendimethalin
- Pentachloronitrobenzene
- Phosphorous acid
- Polyoxorim
- Propamocarb hydrochloride
- Propiconazole
- Pyraclostrobin
- Quinclorac
- Sethoxydim
- Spinosad
- Sulfentrazone
- Sulfur
- Thiophanate-methyl
- Thiophanate-Methyl, Dimeth
- Triadimefon
- Trichlorfon
- Triclopyr
- Trifloxystrobin
- Trinexapac-ethyl
- Vinclozolin
- Zinc

Lawn Care & Ornamentals

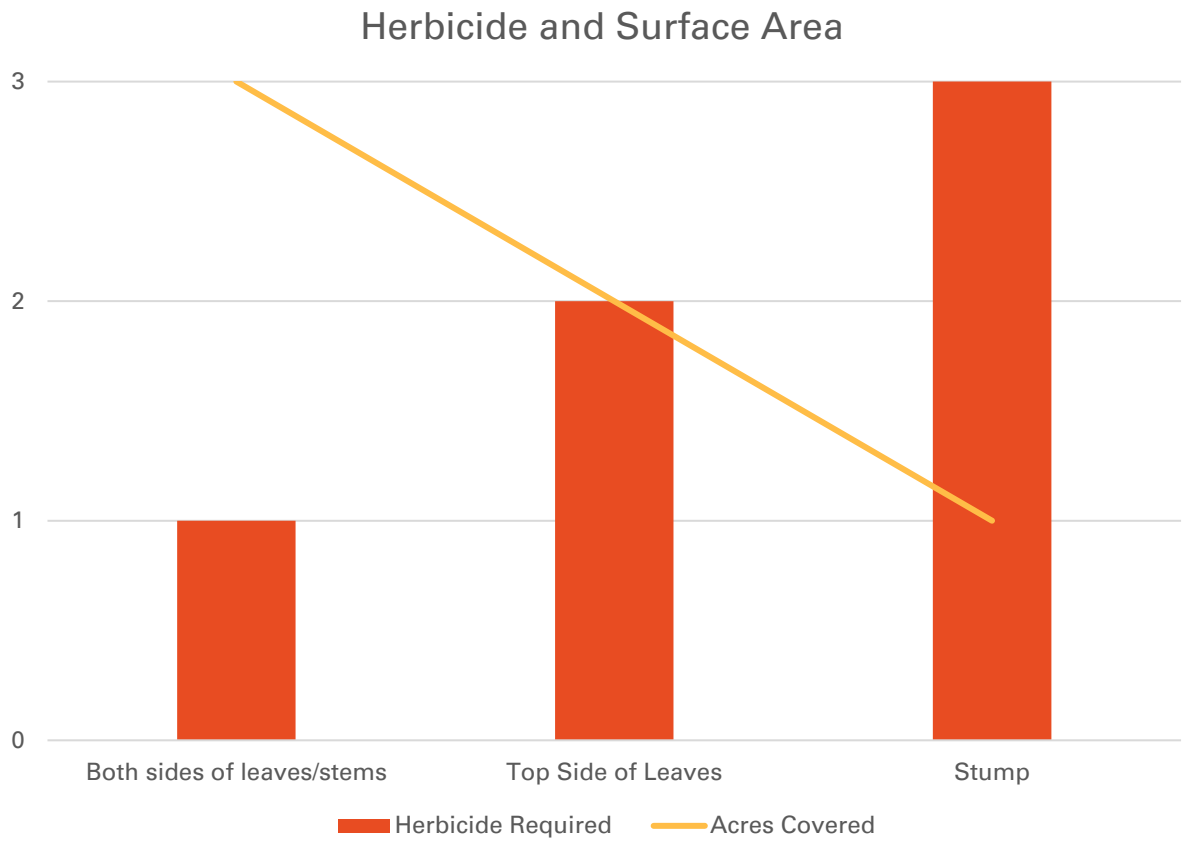
- 2,4-D
- 2,4-DP
- Abamectin
- Acephate
- Allethrin
- Azoxystrobin
- Bacillus popilliae
- Bacillus subtilis
- Bacillus thuringiensis subsp. Kurstaki
- Benefin
- Bifenazate
- Bifenthrin
- Calcium Hypochlorite
- Captan
- Carbaryl
- Carbendazim
- Carfentrazone
- Charcoal
- Chlorantraniliprole
- Chlorfenapyr
- Chloroneb
- Chlorothalonil
- Clopyralid
- Clothianidin
- Copper Hydroxide
- Copper Oxychloride
- Copper Sulfate
- Cyfluthrin
- Debacarb
- Deltamethrin
- Dicamba
- Dichlorprop
- Dicrotophos (Bidrin)
- Diquat
- Dithiopyr
- Ethephon
- Fenarimol
- Fenoxaprop-ethyl
- Ferrous sulfate monohydrate
- Fludioxonil
- Fluroxypyr
- Glyphosate
- Halosulfuron-methyl
- Imazapic
- Imidacloprid
- Iprodione
- Iron phosphate
- Isoxaben
- Lambda-cyhalothrin
- Lithium Hypochlorite
- Malathion
- Mancozeb
- MCPA
- Mecoprop
- Mefenoxam
- Mefluidide
- Mesotrione
- Mineral oil
- Monosodium methanearsonate
- Myclobutanil
- Oxytetracycline Calcium Complex
- Paclobutrazol
- Pendimethalin
- Penoxsulam
- Phosphorous acid
- Piperonyl butoxide
- Potassium salts of fatty acids
- Prallethrin
- Prodiamine
- Prometon
- Propiconazole
- Pyrethrins
- Pyriproxyfen
- Quinclorac
- Siduron
- Sodium nitrate
- Spinosad
- Spiromesifen
- Sulfentrazone
- Sulfur
- Tau-fluvalinate
- Tebuconazole
- Thiabendazole Hypophosphite
- Thiophanate-methyl
- Triadimefon
- Trichlorfon
- Triclopyr
- Trifluralin
- Triforine
- Trinexapac-ethyl
- Zinc ion and manganese ethylenebisdithiocarbamate

Chemical Application Methods

- Foliar
  - High-Volume
    - Hydrosprayer
    - Mistblowers
  - Moderate Volume
    - Birchmeier Backpacks
    - Bloody-Glove
- Cut-Stump
  - Low Volume
    - Buckthorn Blaster
    - Stem-Injection

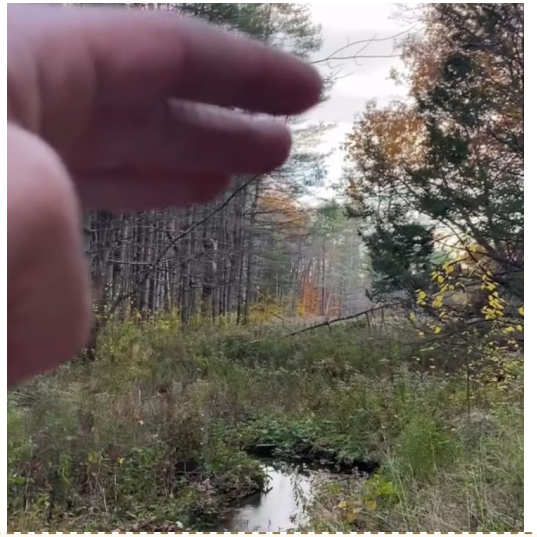


Surface Area and Herbicide Usage



Chemical Use Examples

- Pros:
  - Relatively Inexpensive
  - Low Impact/Low Disturbance
  - Preserves Native Plant Populations
  - 1 Treatment Per Year
  - Effective
  - 90% - 95% Control in 3 – 5 years



The Hybrid Approach

- Chemical Control – Mechanical Control – Chemical Control
  - Japanese knotweed pre-mechanical treatment
  - Mechanical control assisting in seed flushes
  - Chemical control post mechanical control may reduce overall herbicide use
  - Timing of the schedule of items in this scenario are important

Thorndike Place Options

- Option 1: Chemical Control

Table 3: Option 1 - Chemical Control

Task Chemical Approach	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Garlic Mustard Chemical Treatment												
2. Cut Mature Trees (Norway Maple/Tree-of-Heaven) and Stump Treat												
2a. Create Wildlife Piles												
2b. Retain Logs for Chipping/Weed Suppression												
3. Foliar Treatment on Woody Plants*												
4. Foliar Treatment on Japanese Knotweed												
5. Chip Norway/Tree of Heaven logs for 3" mulch after GM treatment												
6. Monitoring/Follow-up Treatment												
7. Monitoring												

Season 1
Season 2
Season 3
Seasons 4, 6, 8, & 10

Thorndike Place Options

- Option 2: Chemical – Mechanical - Chemical

Table 4: Option 2 – Mechanical Control Option

Task Mechanical Pre-Treatment Approach	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Cut Mature Trees (Norway Maple/Tree-of-Heaven) and Stump Treat												
1a. Create Wildlife Piles												
1b. Retain Logs for Chipping/Weed Suppression												
2. Chemical Treatment of Japanese knotweed (Foliar)												
3. Mechanical Mulching Treatment												
4. Site Wide Chemical Control Treatment												
5. Chip Norway/Tree of Heaven logs for 3" mulch after GM treatment												
6. Monitoring												
Season 1												
Season 2												
Season 3												
Seasons 4, 6, 8, & 10												

Questions/Comments